6.0   TMDLs, LOAD ALLOCATIONS, AND MARGIN OF SAFETY

A total maximum daily load (TMDL) is defined as the maximum amount of a pollutant that can be received by a water body and still meet water quality standards. The TMDL is expressed as:

$$TMDL = WLA + LA + MOS \qquad\qquad (14)$$

where WLA = Waste Load Allocations for Point Sources
LA = Load Allocations for Nonpoint Sources
MOS = Margin of Safety

The allocations distribute the TMDL among all point and nonpoint sources. Various methods may be employed to determine how loads should be allocated, and numerous factors, including cost, technical achievability, and equity, should be considered (SWRCB, 2005).

In a recent D.C. Circuit Court of Appeals decision (*Friends of the Earth, Inc. v. EPA, et al.,* No. 05-5015 [D.C. Cir.2006]), the court held that two TMDLs for the Anacostia River did not comply with the Clean Water Act because they were not expressed as "daily" loads. In light of this decision, these TMDLs are being expressed in mass-based, daily time increments for each waterbody.

The proposed TMDLs are identified in Table 6-1 below; they were determined by comparing the existing loads with the loading capacities. Where existing loads are greater than loading capacities, the TMDL is set to the loading capacity levels. Note that for all water bodies, existing loads for total PCBs were lower than the loading capacities, therefore, the proposed TMDLs are being set at existing load values. Setting TMDLs at the lower of either existing load or loading capacity levels should ensure the TMDL targets are eventually met and pollutant levels in sediments decrease over time. The mass reduction that is estimated to be required in order to meet the TMDLs and thereby achieve water quality standards is also shown in Table 6-1.

The proposed TMDLs for San Diego Creek, Upper Newport Bay, and Lower Newport Bay, including WLAs, LAs and MOS, are shown in Table 6-2. For these TMDLs, loads were allocated based on land use area in the Newport Bay watershed, normalized to the estimated relative pollutant source contribution of each land use category (Table 6-3). This approach is consistent with that employed by USEPA in their development of the technical TMDLs (2002), as well as with that of the sediment TMDLs for these waterbodies.

WLAs are defined as that portion of a receiving water's loading capacity that is allocated to its existing or future point sources of pollution (USEPA, 1991), and generally apply to point sources in the watershed regulated under NPDES permits.

Table 6-1. Existing Loads, Loading Capacities, Proposed TMDLs and Needed Reductions for San Diego Creek, Upper and Lower Newport Bay

Water Body	Pollutant	Existing Load	Loading Capacity	TMDL	Needed Reduction
		grams per day			
San Diego Creek	Total DDT	14.31	1.08	1.08	13.22
and Tributaries	Chlordane	1.51	0.70	0.70	0.81
	Toxaphene	1.47	0.02	0.02	1.45
	Total PCBs	0.70	5.30	0.70	Not Required
Upper Newport Bay	Total DDT	6.35	0.44	0.44	5.92
	Chlordane	1.25	0.25	0.25	0.99
	Total PCBs	0.25	2.42	0.25	Not Required
Lower Newport Bay	Total DDT	1.80	0.16	0.16	1.64
	Chlordane	0.10	0.09	0.09	0.01
	Total PCBs	0.66	0.89	0.66	Not Required

They include the county and municipalities covered under a Municipal Separate Storm Sewer System (MS4) permit, Caltrans under its NPDES permit, active construction sites covered under the State's General Permit, other NPDES permit holders, and commercial nurseries covered under waste discharge requirements (WDRs). Because the point source discharges are ultimately directed into San Diego Creek, which is also considered part of the MS4, the entire proposed WLA is being allocated to the MS4, but separated into urban and active construction land use components.

LAs are defined as the portion of a receiving water's loading capacity that is attributed to its existing or future nonpoint sources of pollution or to natural background sources (USEPA, 1991). They are best estimates of the loading, and can range from reasonably accurate estimates to gross allotments, depending on the availability of data and predictive techniques. The LAs apply to non-point sources, including agriculture (but excluding commercial nurseries covered under WDRs), open space, and erosion from natural streams and channels. Agriculture includes row crop growers and small commercial nurseries that are not currently covered under WDRs. An allocation is also provided for "undefined" sources, to account for atmospheric deposition and recirculation of existing bed sediments containing OC pollutants.

A margin of safety (MOS) is required to be incorporated into TMDLs to account for uncertainty in the relationship between pollutant loads and adverse effects to beneficial uses. The MOS may be incorporated implicitly through the use of conservative assumptions to develop the TMDLs, or the MOS can be added to the TMDL as a separate, explicit component. Consistent with the USEPA approach in developing the technical TMDLs (2002), an explicit (10%) MOS is being applied; therefore, the mass-based allocations were calculated as 90% of the TMDL for each

Table 6-2. Proposed TMDLs and Allocations for San Diego Creek, Upper and Lower Newport Bay.

	Type	Total DDT	Chlordane	Total PCBs	Toxaphene
		(grams/day)			
San Diego Creek					
WLA	MS4 (79%)*	0.771	0.497	0.501	0.012
	Includes:				
	Urban Runoff (36%)	0.352	0.226	0.228	0.005
	Construction (28%)	0.273	0.176	0.177	0.004
	Commercial Nurseries (4%)	0.039	0.025	0.025	0.001
	Caltrans (11%)	0.107	0.069	0.070	0.002
	Subtotal – WLA (79%)	**0.771**	**0.497**	**0.501**	**0.012**
LA	Agriculture (5%) (excludes nurseries under WDRs)	0.049	0.031	0.032	0.001
	Open Space (9%)	0.088	0.057	0.057	0.001
	Streams&Channels (2%)	0.020	0.013	0.013	0.0003
	Undefined (5%)	0.049	0.031	0.032	0.001
	Subtotal – LA (21%)	0.205	0.132	0.133	0.003
MOS (10% of total TMDL)		**0.108**	**0.070**	**0.070**	**0.002**
Total TMDL		**1.085**	**0.699**	**0.701**	**0.016**
Upper Newport Bay					
WLA	MS4 (79%)	0.312	0.181	0.179	
	Includes:				
	Urban Runoff (36%)	0.142	0.083	0.082	
	Construction (28%)	0.110	0.064	0.064	
	Commercial nurseries (4%)	0.016	0.009	0.009	
	Caltrans (11%)	0.043	0.025	0.025	
	Subtotal – WLA (79%)	**0.312**	**0.181**	**0.179**	
LA	Agriculture (5%) (excludes nurseries under WDRs)	0.020	0.011	0.011	
	Open Space (9%)	0.036	0.021	0.020	
	Channels & Streams (2%)	0.008	0.005	0.005	
	Undefined (5%)	0.020	0.011	0.011	
	Subtotal – LA (21%)	**0.083**	**0.048**	**0.048**	
MOS (10% of Total TMDL)		**0.044**	**0.025**	**0.025**	
Total TMDL		**0.438**	**0.255**	**0.252**	
Lower Newport Bay					
WLA	MS4 (79%)	0.115	0.066	0.469	
	Includes:				
	Urban Runoff (36%)	0.052	0.030	0.214	
	Construction (28%)	0.041	0.023	0.166	
	Commercial Nurseries (4%)	0.006	0.003	0.024	
	Caltrans (11%)	0.016	0.009	0.065	
	Subtotal – WLA (79%)	**0.115**	**0.066**	**0.469**	
LA	Agriculture (5%) (excludes nurseries under WDRs)	0.007	0.004	0.030	
	Open Space (9%)	0.013	0.008	0.053	
	Channels & Streams (2%)	0.003	0.002	0.012	
	Undefined (5%)	0.007	0.004	0.030	
	Subtotal – LA (21%)	**0.031**	**0.018**	**0.125**	
MOS (10% of Total TMDL)		**0.016**	**0.009**	**0.066**	
Total TMDL		**0.162**	**0.093**	**0.660**	

*Percent WLA (79%) is applied to the TMDL, after subtracting the 10% MOS. Percent WLA and Percent LA add to 100%.

Table 6-3. Calculation of Land Use Allocation Percentages

Land Use	Year 2002 Percent of Watershed Area	Discharge Source Ranking	Relative Weighting	Weighted Allocation Percentage
Urban-Residential	19.7			
Urban-Education etc.	17.7			
Urban-Commercial	9.8			
Urban-Industrial	5.4			
Urban - Non-Roads*‡	52.6	5	210.4	36
Urban-Roads	16.0	5	64	11
Construction**	8	1	160	28
Agriculture***	5.2	2	52	9
Vacant-Open Space	16	4	80	14
Channels&Streams	2	3	13.33	2
Totals	99.8	20	579.73	100

* Urban land use was subdivided to Urban – Non- Roads and Urban Roads to provide an allocation (11% to Caltrans (see Table 6-2));,the subdivision was based upon the percentage of the total Urban land use comprised by Urban-Roads (23%).
**Construction land use percentage was based on the assumption that 8000 acres in the Newport Bay watershed are under active construction.
***Agriculture was further subdivided into point source discharges (i.e., commercial nurseries that are currently covered under WDRs) and nonpoint source discharges (other agriculture, such as row crops). See Table 6-2.
‡Example Calculation for Weighted Allocation Percentage for Urban – Nonroads:
52.6*((20/5)/579.73)*100 = 36%

constituent (Table 6-2). For example, the TMDL for total DDT in San Diego Creek and tributaries is 1.08 grams per day. The 10% MOS, therefore, is 0.11 gram per day, leaving 90% (or 0.97 gram per day) to be distributed between WLAs and LAs. The percentages specified for WLAs and LAs in Table 6-2 are applied to that remaining 0.97 gram per day (TMDL-MOS) and total 100%.

In addition, a conservative approach was taken in developing these TMDLs, which should provide an added degree of protection to aquatic life, predator organisms, and human health. Some of the conservative assumptions and uncertainties pertaining to the TMDLs are identified below:

- The loading capacities are linked to the sediment TMDL target values (62,500 tons allowable load per year for San Diego Creek and Newport Bay), which are long-term annual average values with a 10-year compliance period. Periodic fluctuations are not represented, and actual loading may differ in the short term.
- Long-term sediment deposition patterns were used to calculate the total amount of sediment deposited in each region of Upper and Lower Newport Bay (USEPA, 2002). These values do not represent short-term or localized fluctuations in sediment deposition rates or spatial distribution. Periodic accumulation or scouring could be substantial during large storm events,

resulting in higher or lower deposition rates than the predicted sediment deposition and pollutant concentrations.

- The U.S. Army Corps of Engineers restoration plan for Upper Newport Bay is currently being implemented. This project will change the bathymetry of the Bay, and may affect future sediment deposition patterns and/or spatial redistribution.
- The RMA model was based a sediment transport curve generated based on flow conditions recorded at a gaging station on San Diego Creek at Campus Drive between 1985-1997 (see Section 4). Since 1997, the watershed has become increasingly urbanized and sediment transport patterns may be changing over time. It is possible that the regression model upon which load calculations were based may now overestimate the amount of sediment being discharged to the Bay. A pending contract with RMA will allow for reassessing sediment transport and in-bay distribution using updated flow data and design bathymetry for the Bay.
- USEPA used a constant sediment porosity value (0.65) to calculate existing OCs loads that are associated with sediment deposited in Newport Bay (USEPA, 2002), and staff used this same methodology (see Equation 12 in Section 4). Calculations of existing OCs loads also included sediment deposition rates that were derived from sediment transport models run by Resource Management Associates (see Section 4.3.2), which assumed a sediment porosity of 0.80. Use of the lower porosity (0.65) reflects the potential for consolidation of sediment following deposition, and results in higher calculated values of existing loads.
- Calculations of existing loads for San Diego Creek assumed a total organic carbon (TOC) content of 1 percent. This may be a good estimate of organic carbon content overall, but TOC actually ranges from <1 percent to about 3-4 percent. If the TOC was assumed to be 2 percent, the calculated existing loads would double. During implementation of these TMDLs, organic carbon will be measured in the Creek and existing loads will be directly measured; this will allow refinement of the TMDLs in future phases.
- USEPA calculated existing loads for San Diego Creek using the geometric mean of pollutant concentrations in red shiner that were collected on one date in June 1998 (USEPA); and staff, likewise, used this approach (see Section 4). Tissue concentrations in fish collected on this one particular date were relatively high compared sampling dates between 1995 and 2004. By using this limited data set, calculated existing loads, in most cases, were higher than if the geometric mean of OCs concentrations in fish collected between 1995 and 2004 had been used instead; therefore, this approach represents a "worst-case" estimation of existing OCs loads to the Creek.

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7.0   SEASONAL VARIATION AND CRITICAL CONDITIONS

These TMDLs analyzed the full range of flow conditions within San Diego Creek to account for seasonal variation in flows and existing pollutant loads. Annual deposition within Newport Bay was also accounted for in the RMA model (1998) that formed the basis of existing loads calculations; this model incorporated various flow regimes over multiple years to produce a sediment budget that represented weather patterns and flow conditions over a period of 12 years.

Sediments to which the OC pollutants adsorb are transported primarily within the watershed during the large storms that are most common during the rainy season, considered the months November through April (Figure 7-1). Sediment discharges (and, by virtue of association, OCs discharges) are closely related to rainfall received and flows within San Diego Creek.   Thus, sediment discharges can vary both on a daily basis within a given year (Figure 7-2) and on an annual basis depending upon the amount of rain received (Figure 7-3). Because extensive sediment transport only occurs during the extreme storm events that occur in the rainy season (see Figure 7-2), this seasonality can be considered to be the critical condition for OCs loading.

Although short term fluctuations in OCs loading may occur (e.g., within the time scale of wet and dry seasons within a given year), the adverse effects of the OCs are expected to be manifested over longer time periods in response to food web biomagnification. Short-term daily variations in loading should not cause significant variations in beneficial use effects (USEPA, 2002). Of note, however, is the fact that fish fillet tissue exceedances are largely restricted to the spring/summer season, with virtually no exceedances of OEHHA screening values observed during the winter. This may be due, in part, to the fact that fish tissue lipid concentrations are also higher in the summer compared to the winter months (data not shown).

Because of the pronounced seasonal relationship between sediment discharges and rainfall, and because of the long-term nature of adverse OCs effects, it is recommended that compliance with the proposed TMDLs be evaluated based on the average annual loadings, rather than on a daily basis, measured over a relatively long time period. Table 7-1 shows the proposed TMDLs and needed reductions expressed on an "annual" basis, and Table 7-2 shows the allocations similarly expressed on an "annual" basis. Implementation of the proposed OCs TMDLs would be based on these annual allocations.

Table 7-1. Existing Loads, Loading Capacities, Proposed TMDLs and Needed Reductions (Annual) for San Diego Creek, Upper and Lower Newport Bay

Water Body	Pollutant	Existing Load (grams per year)	Loading Capacity (grams/year)	TMDL (grams/year)	Needed Reduction (grams/year)
San Diego Creek	Total DDT	5222	396	396	4826
and Tributaries	Chlordane	552	255	255	297
	Toxaphene	536	6	6	530
	Total PCBs	257	1933	257	Not Required
Upper Newport Bay	Total DDT	2319	160	160	2159
	Chlordane	455	93	93	362
	Total PCBs	92	884	92	Not Required
Lower Newport Bay	Total DDT	656	59	59	597
	Chlordane	36	34	34	2
	Total PCBs	241	326	241	Not Required

Table 7-2. Proposed TMDLs and Allocations (Annual) for San Diego Creek, Upper and Lower Newport Bay.

Category	Type	Total DDT	Chlordane	Total PCBs	Toxaphene
		(grams per year)			
San Diego Creek					
WLA	MS4 (79%)*	281.6	181.3	182.7	4.3
	Includes:				
	Urban Runoff (36%)	128.3	82.6	83.3	1.9
	Construction (28%)	99.8	64.3	64.8	1.5
	Commercial Nurseries (4%)	14.3	9.2	9.3	0.2
	Caltrans (11%)	39.2	25.2	25.4	0.6
	Subtotal – WLA (79%)	**281.6**	**181.3**	**182.7**	**4.3**
LA	Agriculture (5%) (excludes nurseries under WDRs)	17.8	11.5	11.6	0.3
	Open Space (9%)	32.1	20.7	20.8	0.5
	Streams & Channels (2%)	7.1	4.6	4.6	0.1
	Undefined (5%)	17.8	11.5	11.6	0.3
	Subtotal – LA (21%)	**74.8**	**48.2**	**48.6**	**1.1**
MOS (10% of Total TMDL)		**40**	**26**	**26**	**0.6**
Total TMDL		**396**	**255**	**257**	**6**
Upper Newport Bay					
WLA	MS4 (79%)	113.8	66.1	65.4	
	Includes:				
	Urban Runoff (36%)	51.8	30.1	29.8	
	Construction (28%)	40.3	23.4	23.2	
	Commercial Nurseries (4%)	5.8	3.3	3.3	
	Caltrans (11%)	15.8	9.2	9.1	
	Subtotal – WLA (79%)	**113.8**	**66.1**	**65.4**	
LA	Agriculture (5%) (excludes nurseries under WDRs)	7.2	8	7	
	Open Space (9%)	13.0	7.6	7.5	
	Streams & Channels (2%)	2.9	1.7	1.7	
	Undefined (5%)	7.2	4.2	4.2	
	Subtotal – LA (21%)	**30.2**	**21.4**	**20.3**	
MOS (10% of Total TMDL)		**16**	**9**	**9**	
Total TMDL		**160**	**93**	**92**	
Lower Newport Bay					
WLA	MS4 (79%)	41.9	24.2	171.4	
	Includes:				
	Urban Runoff (36%)	19.1	11.0	78.1	
	Construction (28%)	14.9	8.6	60.7	
	Commercial Nurseries (4%)	2.1	1.2	8.7	
	Caltrans (11%)	5.8	3.4	23.9	
	Subtotal – WLA (79%)	**41.9**	**24.2**	**171.4**	
LA	Agriculture (5%) (excludes nurseries under WDRs)	2.7	1.5	10.8	
	Open Space (9%)	4.8	2.8	19.5	
	Streams & Channels (2%)	1.1	0.6	4.3	
	Undefined (5%)	2.7	1.5	10.8	
	Subtotal – LA (21%)	**11.2**	**6.4**	**45.5**	
MOS (10% of Total TMDL)		**5.9**	**3.4**	**24**	
Total TMDL		**59**	**34**	**241**	

*Percent WLA (79%) is applied to the TMDL, after subtracting the 10% MOS. Percent WLA and Percent LA add to 100%.

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